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Hartmann

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(54) **CENTER-SUPPORTED WALL PANEL**

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(51) **Int. Cl.**

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E04B 1/08	(2006.01)
E04B 2/58	(2006.01)
E04C 2/38	(2006.01)
E04B 1/24	(2006.01)

(52) **U.S. Cl.**

CPC ... ***E04B 1/08*** (2013.01); *E04B 1/24* (2013.01); ***E04B 2/58*** (2013.01); ***E04C 2/384*** (2013.01)

(58) **Field of Classification Search**

CPC E04B 1/24; E04B 1/08; E04B 2/58; E04B 2/7457; E04B 2/7854; E04C 2/38; E04C 2/384; E04C 2003/0473

USPC 52/106, 638, 653.1, 653.2, 481.1, 693

See application file for complete search history.

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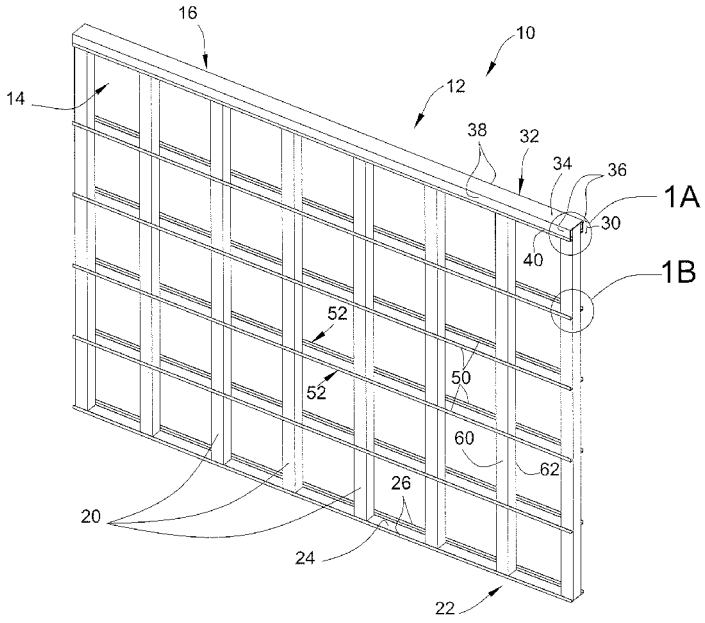
(57) **ABSTRACT**

A wall panel is configured as a load-bearing structure for supporting vertical loading in a building. The wall panel forms a frame with first and second faces configured to receive sheathing and has thickness defined between the first and second faces. The wall panel includes a plurality of vertical load-bearing columns centrally disposed between the first and second faces of the wall panel frame. A load distribution member is disposed at the top of the wall panel and is coupled to the load-bearing columns, which are supported at the bottom of the wall panel by a lower member. A plurality of sheathing supports are disposed on opposite sides of the load bearing columns, and each includes an attachment surface disposed at a distance from the load-bearing column. The attachment surfaces define the respective faces of the wall panel frame and are configured to hold the sheathing.

17 Claims, 7 Drawing Sheets



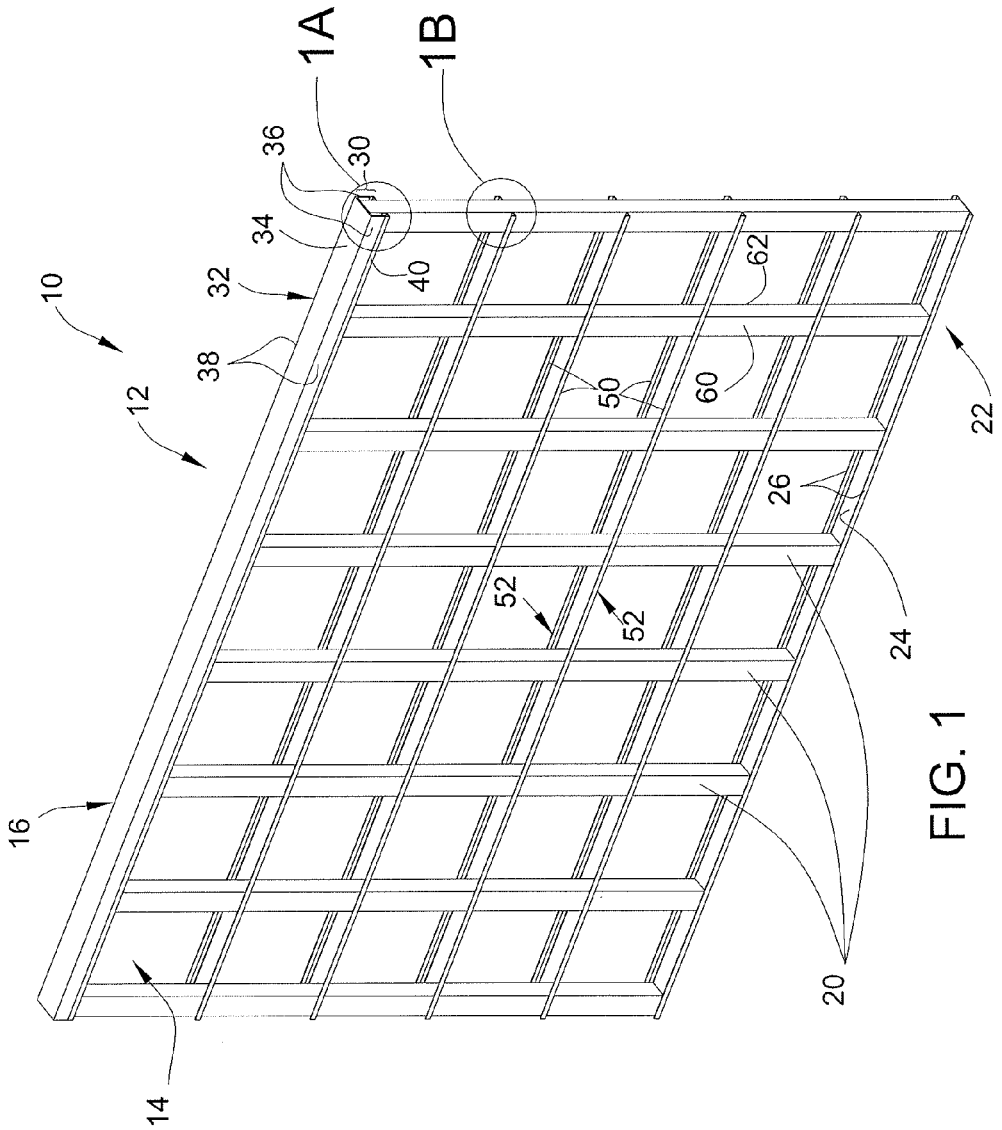


FIG. 1

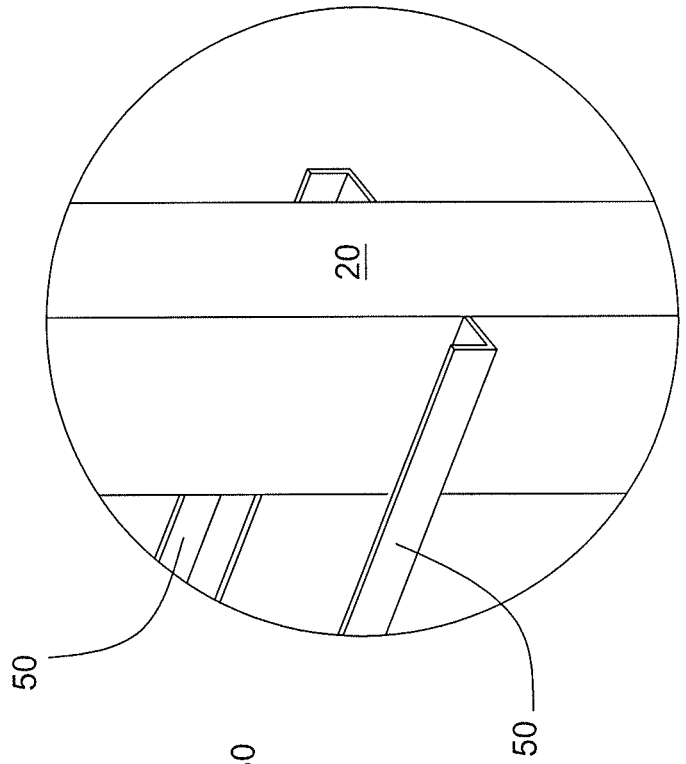


FIG. 1B

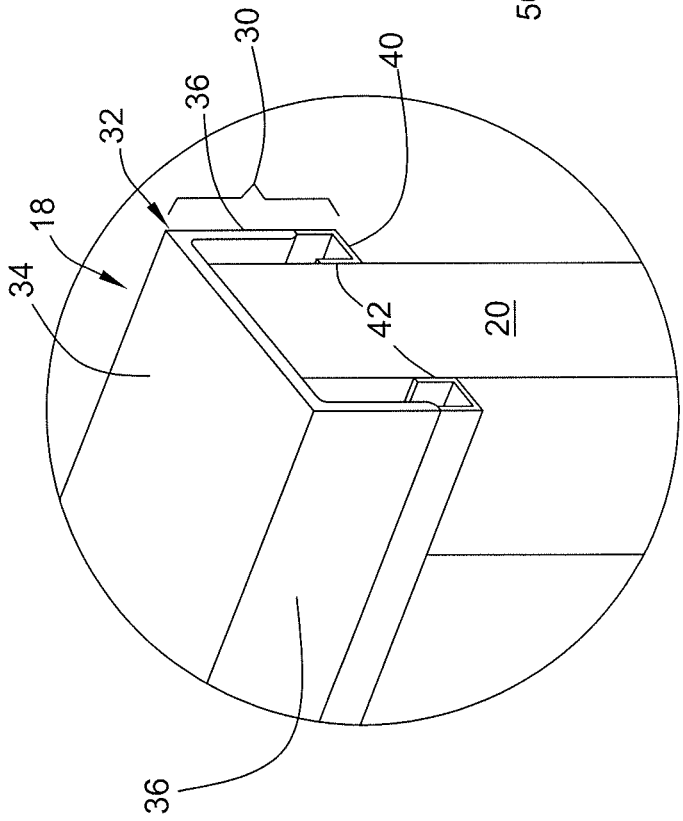


FIG. 1A

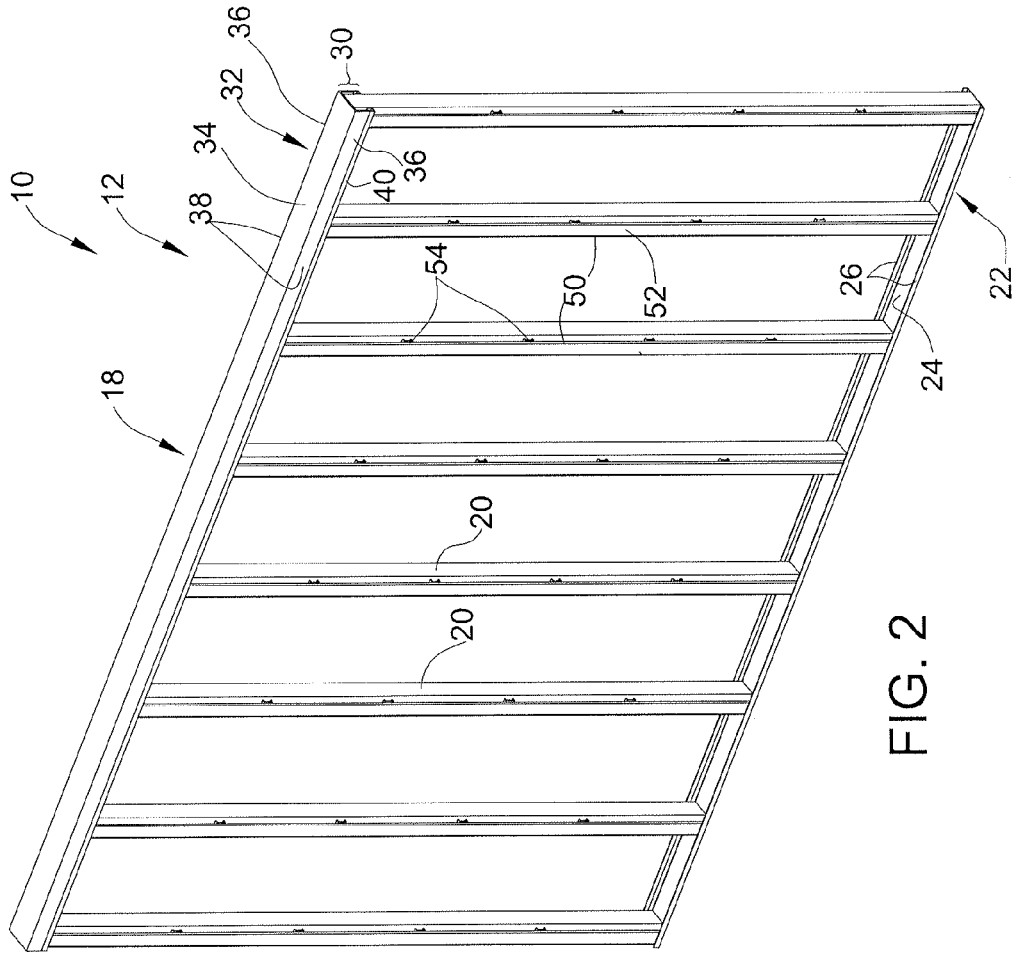


FIG. 2

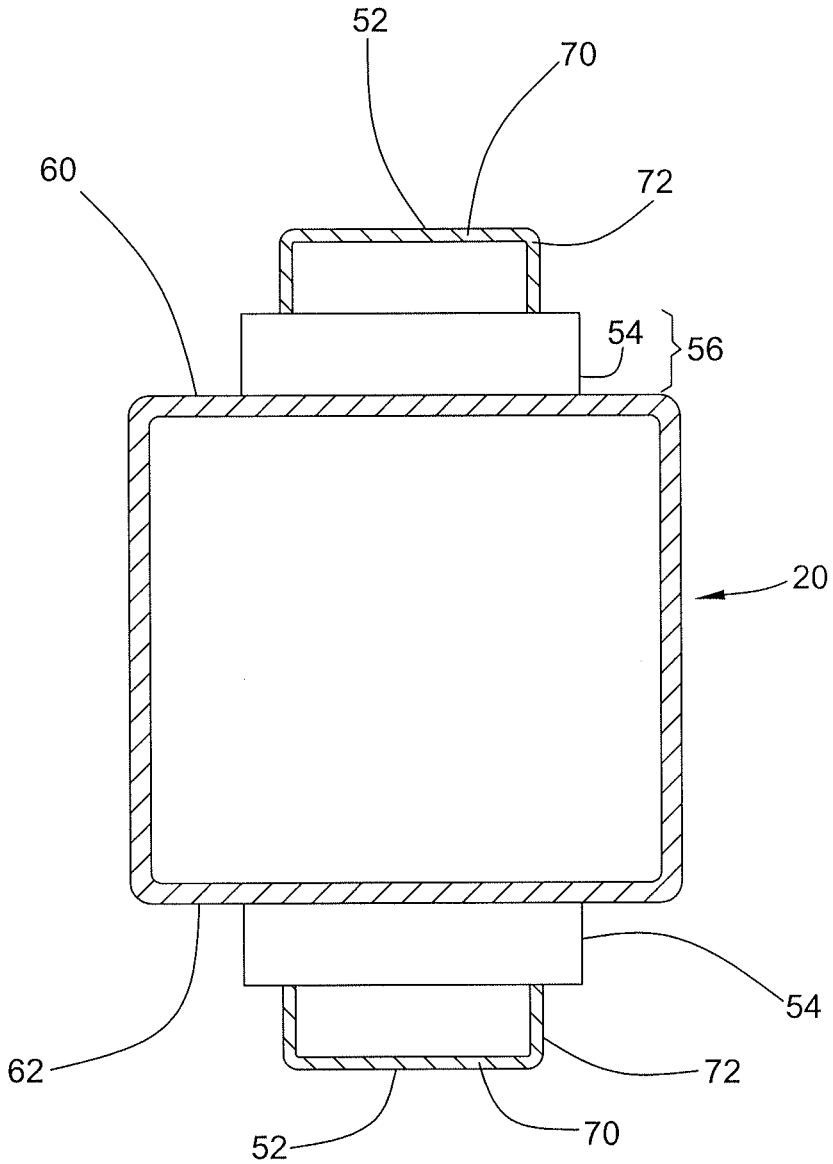


FIG. 2A

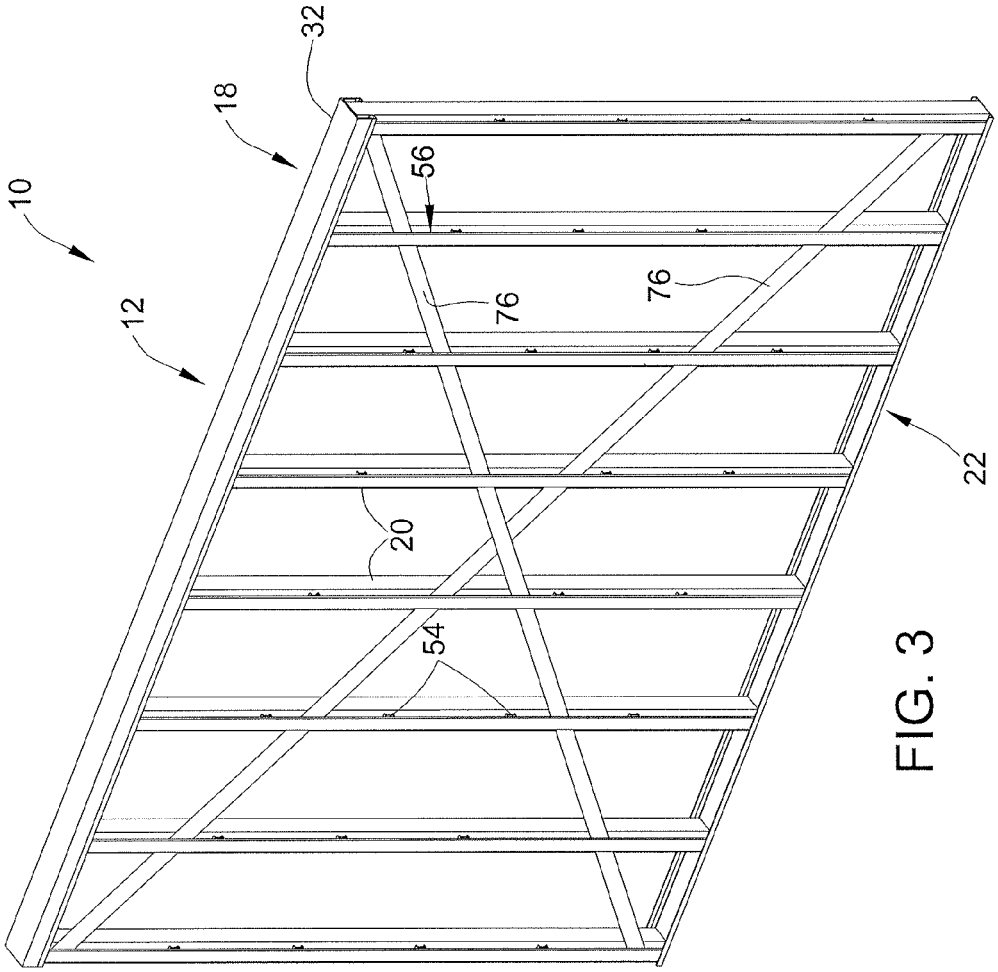


FIG. 3

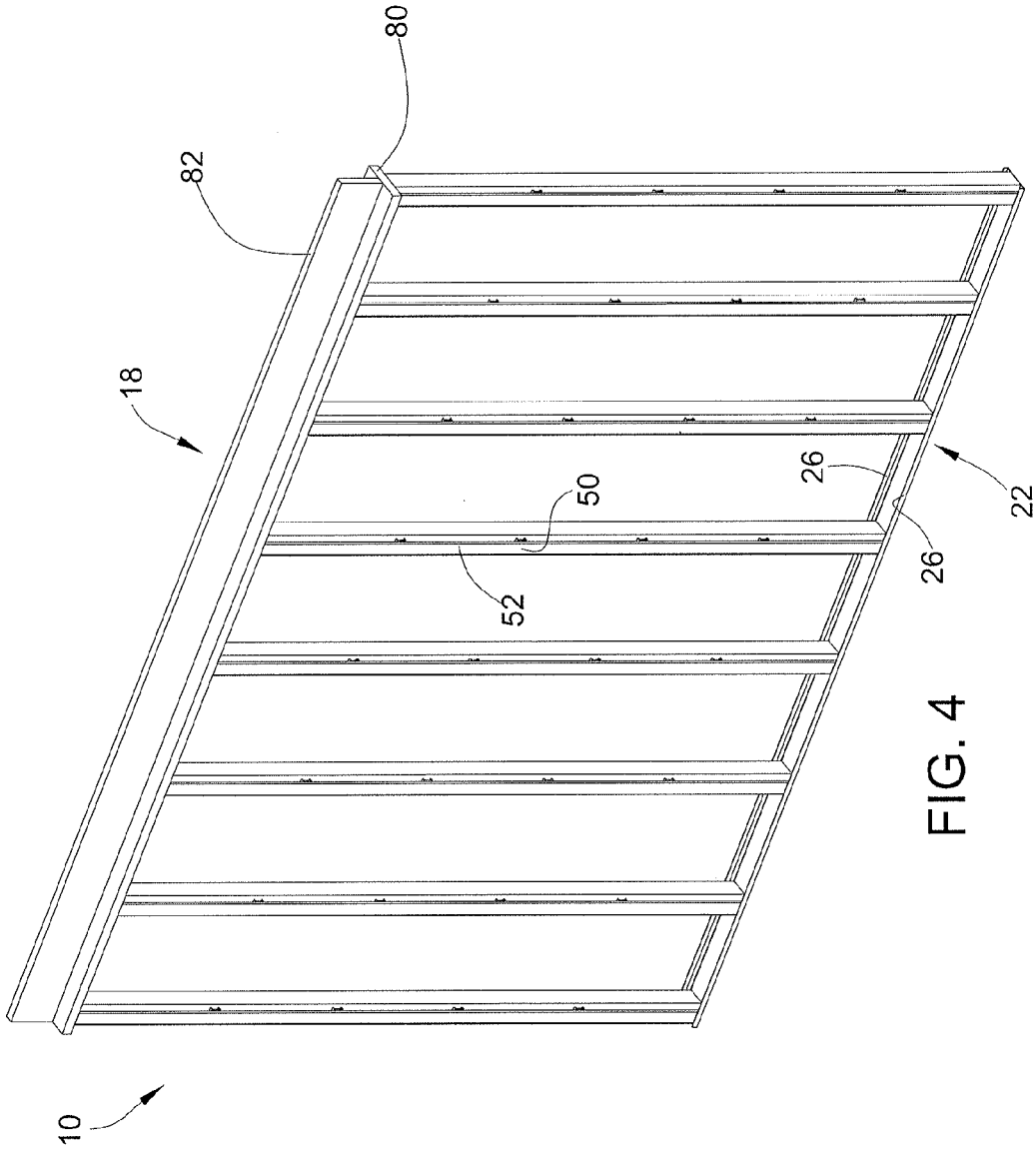


FIG. 4

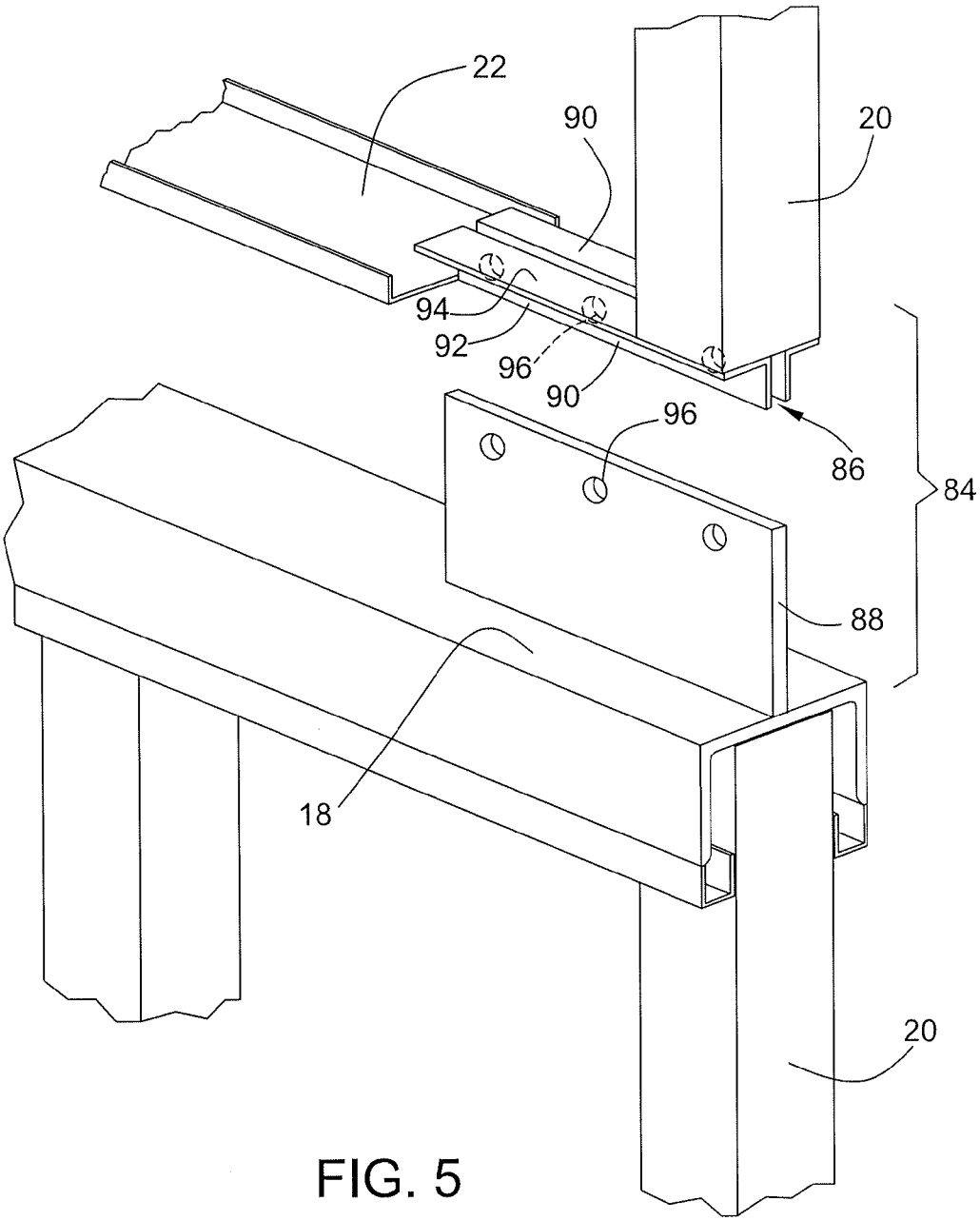


FIG. 5

CENTER-SUPPORTED WALL PANEL

FIELD OF THE INVENTION

The invention relates to modular wall panels for use in construction of high rise structures, including but not limited to floor support wall panels.

BACKGROUND OF THE INVENTION

When constructing high-rise buildings that include more than one floor, typical construction methods include creating a temporary support structure on a newly formed floor surface. This support structure is used to support molds that will form the next floor slab. Thus, the construction of multi-floor buildings requires the sequential pouring of floors, which also involves the erection and removal of support structures and/or scaffolding on successive floors.

Typical support structures include scaffolding constructed by tubing having a round cross section. Such scaffolding is erected on the floor slab of a newly poured floor to support molds that will be used to pour the floor above. The scaffolding may be dismantled when pouring of the above floor is complete, and moved for re-erection when successively pouring other floors.

The successive re-use of scaffolding in erecting, dismantling, and re-erecting the structure for each floor of a multi-story building can be quite labor intensive and time consuming. Moreover, the wall structures of the building must be constructed for the newly formed floors after the construction or pouring of the "floor" and "ceiling" slabs are complete.

BRIEF SUMMARY OF THE INVENTION

The present disclosure sets forth an advantageous wall panel and method of making the wall panel. In an embodiment, the wall panel is configured as a load-bearing structure for supporting vertical loading in a building. The wall panel forms a frame with first and second faces configured to receive sheathing and has thickness defined between the first and second faces. The wall panel includes a plurality of vertical load-bearing columns centrally disposed between the first and second faces of the wall panel frame. A load distribution member is disposed at the top of the wall panel and is coupled to the load-bearing columns, which are supported at the bottom of the wall panel by a lower member. A plurality of sheathing supports are disposed on opposite sides of the load bearing columns, each of the sheathing supports including an attachment surface disposed at a distance from the load-bearing columns, the attachment surfaces defining the respective faces of the wall panel frame and being configured to hold the sheathing on the wall panel frame.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Embodiments of the present invention are described in more detail below with reference to the drawings, in which:

FIG. **1** shows a perspective view of a wall panel including a centrally disposed load-bearing columns;

FIG. **1***a* shows a detailed view of a top portion of the wall panel of FIG. **1**;

FIG. **1***b* shows a detailed view of a sheathing support of the wall panel of FIG. **1**;

FIG. **2** shows a perspective view of another embodiment of a wall panel including centrally disposed load-bearing columns;

FIG. **2***a* shows a detailed top view of a column and sheathing support of the wall panel of FIG. **2**;

FIG. **3** shows a perspective view of another embodiment of a wall panel including centrally disposed load-bearing columns with cross braces;

FIG. **4** shows a perspective view of another embodiment of a wall panel including centrally disposed load-bearing columns; and

FIG. **5** shows a detailed exploded view of a wall panel connection.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** shows a wall panel that provides a load-bearing structure for supporting vertical loading in a building. Various different uses and advantages of wall panels, particularly with respect to their relationship with surrounding structural elements are described in U.S. patent application Ser. Nos. 12/868,474, now U.S. Pat. No. 8,448,387, and 13/163,540, now abandoned, which are hereby incorporated by reference herein in their entirety.

The wall panel **10** of FIG. **1** is configured as a load-bearing frame **12** and includes first and second broad faces **14**, **16** that are configured to receive sheathing, which may be interior sheathing, such as dry-wall or gypsum board, or exterior sheathing. Of course, the wall panel may be configured such that the first face **14** of the wall panel is covered with exterior sheathing while the second face **16** is covered with interior sheathing. For internal wall sections, both faces can be covered with interior sheathing. The load bearing frame **12** of wall panel **10** includes a load distribution member **18** disposed at a top of the wall panel, a plurality of vertical load-bearing columns **20** spanning the height of the wall panel, and a lower member **22** supporting the columns **20**.

As shown in FIG. **1**, the load bearing columns **20** are disposed along the length of the wall panel in spaced apart relation. Distinct from other wall panel constructions, each load-bearing column **20** is centrally disposed with respect to the width of the wall between the first **14** and second **16** broad faces that are configured to receive sheathing. Thus, the load-bearing columns **20**, which are spaced individually along the length of the wall panel **10**, can be larger than the structural tubes used in many wall panels that are positioned together in pairs. As a result, the load capacity of each column **20** can be considerably higher than the individual structural tubes used in pairs in other wall panel constructions.

The size, shape, material and spacing of the load-bearing columns may be selected based on the load-bearing and other construction requirements of the wall. In the illustrated embodiments, the load bearing columns **20** are formed by square steel tubes of **4"×4"** cross-section, and are spaced along the length of the wall panel every 24". However, the bearing columns could be formed by other materials, such as different structural metals or composites, or could take other forms such as beams or channels. Moreover, the cross-section of the columns could be smaller or larger depending on the load-bearing requirement of the wall and/or the wall panel thickness. Preferably, however, the load-bearing columns **20** will have a smaller cross-section than the thickness of the wall panel such that a space is left between each of the opposing sides of the load-bearing columns **20** and the respective neighboring face of the wall panel frame. The function of this space will be described in more detail below.

As set forth above, the load-bearing columns **20** are supported on a lower member **22** that defines the lower end of the wall panel frame. In one embodiment, the lower member **22** may also extend outward from the load-bearing columns **20**,

on either side, toward the first and second faces **14**, **16** of the wall panel frame. For example, the lower member **22** may be formed by a steel track, which is in the form of a channel with a web **24** and two upwardly extending flanges **26**, as shown in the drawings. In the illustrated embodiment, the lower member **22** is formed by 6" track with the 4"×4" steel tubes of the columns being centrally disposed between the flanges **26** of the track's channel, leaving a 1-inch space on each side of the steel tubes. Preferably, the load-distribution columns are attached to the lower member **22**. This can be achieved by welding the steel tube columns to the web **24** of the steel track lower member **22** around the periphery of the column, with one or more weld segments or tacks. Alternatively, the steel tube columns **20** could be attached to the steel track lower member **22** by other means such as L-brackets and fasteners. In the illustrated arrangement, the side flanges **26** of the lower track are spaced from the first and second sides of the columns and are configured to receive sheathing mounted thereon. Accordingly, the track flanges **26** contribute to defining the thickness of the wall panel frame **12** and the location of the first and second wall panel faces **14**, **16** that receive sheathing.

The load-bearing columns **20** extend up from the lower member **22** to the load distribution member **18** at the top of the wall panel **10**. In the embodiment shown in FIG. **1**, the load distribution member **18** is in the shape of a channel member **30** with a downward facing opening that receives the columns **20** therein, as shown in greater detail in FIG. **1**A. The illustrated channel member **30** is formed by a structural channel **32** defined by a web **34** that extends across the top of the wall panel **10** and two flanges **36** that extend downward from the web **34** on opposite sides of the load-bearing columns **20**. With the channel member **30** in place, the web **34** of the structural channel **32** is supported on the top end of the plurality of columns **20** of the wall panel. Thus, the top of the wall panel **10** provides a flat surface formed by the web **34** of the structural channel **32**. Advantageously, this flat surface provides an appropriate support platform for loads disposed on top of the wall panel, such as structural components of the next higher floor in the structure or building being constructed. The load distribution member **18** directs the load from above the wall panel **10** down and through each of the load-bearing columns **20**, so that the wall panel **10** is able to sufficiently support large loads disposed thereon, such as several additional floors of a building.

The width of the channel member **30**, as defined by the width of the structural channel **32**, is preferably sized so that the outward facing sides **38** of the flanges **36** align with the flanges **26** of the steel track lower member **22**. As a result, the channel member **30** also contributes to defining the first and second faces **14**, **16** of the wall panel frame **12** and the position of any sheathing that is attached to the wall panel **10**.

At a lower end of each of the flanges **36** of the structural channel **32** is a guide element **40** that extends inward from the respective first **14** or second **16** face of the wall panel frame **12** toward the columns, as can be seen in detail in FIG. **1**A. Each of the guide elements **40** can include an guide surface **42** disposed on an inner side of the channel member **30** abutting, or nearly abutting, an adjacent face of a neighboring load-bearing column **20**. This configuration, with two guide elements **40** disposed on opposite sides of the channel member **30**, can be particularly advantageous when assembling the wall panel **10**. Specifically, the channel member **30** can be prefabricated before attachment to the columns **20** by fixing the guide elements **40** on opposite sides of the structural channel **32** at the lower ends of the flanges **36**, as explained above. As a result, the guide surfaces **42** of the guide elements **40** are spaced apart from one another on opposing sides of the guide channel **30** at or near the width of the columns. Thus, the columns can be easily positioned and held in place within the guide channel **30** of the load distribution member **18** until the columns **20** are fixed in place and attached to the load channel member **30** of the load distribution member **18**. Similar to the connection between the columns **20** and the steel track of the lower member **22**, the channel member **30** can also be fixed on the top end of the columns **20** by welding. Further, the connection between the columns **20** and the load distribution member **18** could alternatively be made with brackets and fasteners.

The size, shape and material of the load distribution member **18** and its components may be selected based on load-bearing and other construction requirements of the wall panel **10**. In the specific embodiment illustrated in FIGS. **1** and **1**A, the channel member **30** of the load distribution member **18** is formed by a unitary structural channel **32** and two smaller channels that form the guide elements **40**. Alternatively, the structural channel **32** can be formed by individual components that are fastened together, such as a first plate to form the web **34** and two smaller plates to form the flanges **36** or a pair of angled members. In other embodiments, the guide elements **40** could be composed of different members, such as square tubing, solid spacers or plates. The illustrated channels that form the guide elements **40** advantageously provide a wide guide surface **42** towards the inside and a similar surface on the outside, which may be used for attaching members to the wall panel, such as sheathing. The shown load distribution member **18** is formed by a 6" wide MC channel with flanges **36** that may be between 2½ and 3½ inches long. As a result, the structural channel **32** extends by about 1-inch in an outward direction on both sides of the load-bearing columns **20**. To accommodate the extension of the structural channel **32** on each side of the columns **20**, the guide elements may be formed by C-channels measuring about 1×1 inches. The channels forming guide elements **40** are shown as opening on an upper side. It is also possible that the channels open on the inside or lower side.

Each broad side of the wall panel frame **12** includes a plurality of sheathing supports **50** that are coupled to the load-bearing columns **20**. Each sheathing support **50** includes an attachment surface **52** for receiving a sheathing to finish the construction of a wall. The plane that is defined by the plurality of attachment surfaces **52** of the sheathing supports **50** on one side of the columns **20**, thus, defines the corresponding face **14** or **16** of that side of the wall panel **10**. As set forth above, the sheathing or hanger clips attached to sheathing materials such as stone are received on the sheathing supports **50**, and thus on the wall panel **10**. Alternatively, interior sheathing material such as drywall or wood can be attached by driving fasteners directly into the sheathing supports **50**. In the embodiment shown in FIG. **1**, the sheathing supports **50** run horizontally and are attached directly to a neighboring side of each of the columns **20** along the length of the wall panel **10**. Thus, on a first side of the wall panel, a plurality of sheathing supports **50** are coupled to a first side **60** of each column **20**. The sheathing supports **50** are further arranged to provide the attachment surface **52** along the length of the wall panel at a distance from the first side **60** of the first side **60** of the columns **20**, and thereby form the first face **14** of the wall panel. Similarly, additional sheathing supports **50** are coupled to a second side **62** of each of the columns **20** and also arranged to provide their respective attachment surfaces at a distance from the second sides **62** of the columns **20** and thereby form the second face **16** of the wall panel. Preferably, the attachment surfaces **52** of the sheathing supports **50** on each side of the wall panel are

aligned with the outer surface of the flange **26** of the steel track lower member **22** and with the outer surface channel member **30** on the respective side of the wall panel **10**. Further, it is contemplated that the orientation and number of sheathing supports **50** can be tailored to be compatible with any particular type of sheathing.

In the embodiment of FIG. **1**, shown in further detail in FIG. **1**B, the sheathing supports **50** are formed by angle members, with the end of one leg of the angle member being fixed to the respective side **60**, **62** of the column **20**. The second leg of the angle member is thus set apart from the column **20** and forms the attachment surface **52**. The sheathing supports **50** can also be formed of other structural elements such as hollow sections, beams, or channels, as shown and described in more detail below. The specific material used for the sheathing supports **50** shown in FIG. **1** is a 1×1 inch steel angle. This size sets the attachment surface **52** of the sheathing supports **50** at 1-inch from the columns **20** on each side of the wall panel **10** in alignment with the flanges **26** of the track of the lower member **22** and the flanges **36** of the structural channel **32** of the load distribution member **18**.

FIG. **2** shows another embodiment of a wall panel **10** including centrally disposed load-bearing columns **20**. Similar to the embodiment of FIG. **1**, the columns **20** are supported on a lower member **22** formed by a steel track channel, abutting a web **24** of the channel and centrally disposed between the flanges **26**. Likewise, the load distribution member is also formed by a channel member **30** including a structural channel **32** opening downward and two guide elements **40** disposed at ends of the flanges **36** of the structural channel **32**. It should be appreciated that each of the features of the wall panel shown in FIG. **2** may be embodied by the descriptions set forth above with respect to FIG. **1**, except where otherwise indicated.

The wall panel **10**, of FIG. **2** differs from that shown in FIG. **1**, in that the sheathing supports **50** extend vertically from a lower end of the wall panel toward a top end of the wall panel. To hold the supports **50** on the wall panel **10**, each sheathing support **50** is coupled to a respective load-bearing column **20** and runs parallel to the respective neighboring column **20**. In the illustrated embodiment, each of the columns **20** includes a sheathing support **50** disposed on the visible first side **60** of each column. Together, the attachment surfaces **52** of the sheathing supports **50** form the first face **14** of the wall panel frame **12**. It should be understood that the second sides **62** of the columns **20** would likewise include sheathing supports **50** with corresponding attachment surfaces **52** that form the second face **14** of the frame **12**. Although a sheathing support is shown on each of the columns **20**, it is conceivable that some columns **20** may not include a sheathing support disposed thereon. Further, while the sheathing supports **50** are shown as extending over the entire height of the wall panel **10**, this construction is not necessary, and the sheathing supports **50** could be sized to extend over only a certain portion of the wall panel **10**.

As can be seen in FIG. **2**, there are no horizontal members extending across the wall panel **10** between the load distribution member **18** and the lower member **22**. Of particular relevance is the fact that the wall panels disclosed herein may be constructed without structural bridging extending between the load-bearing columns. This ability is afforded by the large size and robust strength of the columns and, to a lesser extent, their centered position between the first and second faces of the wall panel.

In the particular embodiment shown in FIG. **2**, the sheathing supports **50** are spaced apart from the load bearing columns **20** and attached thereto by spacers **54**. As a result, a gap **56** is formed between sheathing supports **50** and the columns **20** to which they are attached. This gap **56** provides particular advantages as described in further detail below with respect to FIG. **3**.

The configuration of the vertical sheathing supports **50** shown in FIG. **2** can be further explained with reference to FIG. **2**A, which shows a top-view cross-section of a load-bearing column **20** of the wall panel **10** and sheathing supports **50** disposed on opposite sides **60**, **62** of the column **20**. As illustrated, the two sheathing supports **50** are configured in the form of channels including a web **70** and two flanges **72**. The sheathing supports **50** are attached to the spacer **54** opposite the columns **20**, and the spacers **54** are fixed on a respective side of the column **20**. The channels of the sheathing supports **50** can be specifically arranged with the ends of the flanges **72** being fixed to the spacers **54** and the web **70** of the channels **50** providing the attachment surface **52** of the sheathing support **50**. The spacers **54** define the distance between the sheathing supports **50** and the columns **20**, and thus define the size of the gap **56** on each side of the wall panel **10**. Various different structures can be used to form the spacers, including hollow tubing, thick material sheets, beams, or, as illustrated, a section of channel. The use of channel for the spacers **54** is particularly advantageous, since the material of the spacer **54** may be the same as that used for the sheathing support **50**. In the illustrated construction, short sections of channel are disposed at 90° from the sheathing support channels and fixed to the respective side of the column. In particular, the spacer channel **54** is arranged with the channel opening against the column **20** and the flanges are attached to the respective column side **60**, **62**. The sheathing support channels **50** can then be fixed on the web **70** of spacer channel. Spacers **54** as shown in FIGS. **2** and **2**A may be distributed at various locations along the respective load-bearing column **20** along the height of the wall panel **10**.

The particular materials used in the illustrated construction of FIGS. **2** and **2**A include 1.5×0.5 inch channel for both the sheathing supports **50** and the spacers **54**. This construction forms an attachment surface **52** of the sheathing support **50** that is 1.5 inches wide, which provides adequate width for attaching various different types of sheathing material to the sheathing supports and is a standard desired width for accommodating a seam between two sheets of sheathing. Further, the use of the described channel for the supports **50** and spacers **54** provides a 0.5 inch gap between each sheathing support **50** and the respective side of the column **60**, **62**, and also positions the attachment surfaces **52** of the opposing sheathing supports **50** at 6 inches apart, such that the attachment surfaces align with the flanges **26** of the track of the lower member **22** and the flanges **36** of the structural channel **32** of the load distribution member **18**.

FIG. **3** shows a wall panel **10** similar to that of FIG. **2**, and including columns **20** that supported on a lower member **22** formed by a steel track channel, abutting a web **24** of the channel and centrally disposed between the flanges **26** of the channel. Likewise, the load distribution member **18** at the top of the wall panel **10** is also formed by a channel member **30** including a structural channel **32** opening downward and two guide elements **40** disposed at ends of the flanges **36** of the structural channel **32**. Further, the sheathing supports **50** are again positioned vertically, and each is attached at a distance to a respective load-bearing column. It should be appreciated that each of the features of the wall panel shown in FIG. **3** may be embodied by the descriptions set forth above with respect to FIGS. **1** and **2**, except where otherwise indicated.

Further, the wall panel **10** of FIG. **3** is specifically arranged to provide improved resistance to shear stresses, which makes

this wall panel particularly suitable for use when constructing the core portion of a building, for surfaces of a building exposed to wind or seismic loading, or for any other wall portions expected to bear high shear loading. Specifically the wall panel **10** of FIG. **3** includes two cross braces **76**, which extend in an "X" configuration between the four corners of the wall panel frame **12**. The cross braces **76** are advantageously disposed in the gaps **56** between the columns **20** and sheathing supports **50**. Thus, the location of the cross braces **76** is enabled by the spacers **54** disposed between the sheathing supports **50** and columns **20**. In a preferred embodiment, each of the two cross braces is disposed on one side of the columns **20**, so that each cross brace can utilize the full width of the gap. Alternatively, it is conceivable for the cross braces to be disposed on the same side of the columns **20**. At their ends, the two cross braces **76** may be bolted, pinned, or welded to the load bearing columns **20** at the ends of the wall panel **10**.

FIG. **4** shows a wall panel **10** also similar to that of FIG. **2**, and including columns **20** that are supported on a lower member **22** formed by a steel track channel, abutting a web **24** of the channel and centrally disposed between the flanges **26** of the channel. Likewise, the sheathing supports **50** are again positioned vertically, and each is attached at a distance to a respective load-bearing column. It should be appreciated that each of the features of the wall panel shown in FIG. **4** may be embodied by the descriptions set forth above with respect to FIGS. **1** and **2**, except where otherwise indicated.

The load distribution member **18** of the wall panel **10** of FIG. **4** differs from that of FIGS. **1-3**. In FIG. **4**, the load distribution member **18** is formed by a flat bar **80** extending across the top of the wall panel **10**. The flat bar **80** is arranged horizontally with a wide side face laid over the top ends of the load-bearing columns **20**. It may also be advantageous to include a vertical flat bar **82** extending up from the top of the horizontal bar **80**. The vertical bar **82** provides additional support for bearing loads, particularly shear loads. Accordingly, the vertical bar **82** is particularly advantageous in a shear wall panel that includes cross braces **76**, a shown in FIG. **3**. It also possible to use the vertical bar **82** with the load distribution member **18** shown in FIGS. **1-3**, which includes the channel member **30**. The vertical flat bar **82** is preferably centrally aligned with the load-bearing columns **20**, between the first and second faces **14**, **16** of the wall panel frame **12**. The two flat bars **80**, **82** may be formed of the same size bar, or of different size metal flat bars. In the illustrated embodiment, the horizontal flat bar extends further outward than the attachment surfaces **52** of the sheathing supports **50** and the side flanges **26** of the lower member steel track **22**. Thus, the sides of the horizontal flat bar may extend further outward than the frame faces **14**, **16** that hold sheathing to the wall panel. This additional extension of the horizontal flat bar enlarges the support area of load distribution member **18**, allowing additional space for supported structures, such as pre-cast concrete elements. In the particular embodiment shown in FIG. **4**, both the horizontal and vertical flat bars are ⅜×9 inch bars.

FIG. **5** shows a connection **84** that may be included in any of the above wall panels **10** shown in FIGS. **1-4**. The connection **84** is preferably included at both ends of the wall panel **10** and is formed by a vertical connecting bar **88** extending vertically upward from the load distribution member **18** of a lower wall panel **10** and is placed within a slot **86** disposed between two holding members **90** at the bottom of an upper wall panel **10**. In the illustrated embodiment, each of the holding members **90** and the vertical connecting bar **88** includes connecting holes **96** distributed along their respective lengths. For connecting the lower wall panel and the upper wall panel the vertical connecting bar **88** is inserted into the slot **86** disposed between the two holding members **90**. Preferably, the width of the slot **86** is substantially equal to the width of the connecting bar **88** so that a snug fit is formed between these two elements. With the connecting bar **88** and holding members **90** assembled, the connecting holes **96** of the vertical connecting bar **88** and the holding members **90** are preferably aligned so that bolts can be passed through the holes **96** and secured to firmly hold the upper and lower wall panels together but at a spaced-apart relation that leaves a horizontally extending gap that can accommodate the structure of a floor that is poured or otherwise built therebetween. The connection **84** is particularly advantageous because a strong connection can be made between the upper and lower wall panels without the need for welding the panels together. As a result, any welding that is required for the construction of the individual wall panels **10** can be accomplished off-site at a manufacturing location, but at the construction site of a building the panels can be easily and quickly attached using bolts. This connection **84** is particularly advantageous for connecting shear wall panels, such as that which is shown in FIG. **3**, so that shear loading can be appropriately transferred through the connected wall panels **10**.

In the embodiment shown in FIG. **5**, the vertical connecting bar **88** is formed by a section of steel flat bar extending up from the load distribution member **18**. In a particular embodiment, the connecting bar **88** is formed by a flat bar having a thickness of about ⅜ of an inch and a length of about 9 inches. The holding members **90** are formed by two steel angles, each having a vertically extending leg **92**. The two vertically extending legs are spaced apart to form the slot **86** in which the vertical connecting bar is inserted. In the particular embodiment shown, the vertical legs **92** of the holding members **90** are spaced slightly more than ⅜ of an inch apart to accommodate the vertical connecting bar **88** with a clearance fit. The angle holding members **90** are each arranged to have a horizontal leg **94** above the vertical leg **92** and extending outward from the slot. In combination the horizontal legs **94** of the two holding members **90** form a platform to support a column **20** at the end of the wall panel **10**, and thus the holding members **90** form a part of the lower member **22** that supports the columns **20**.

In the illustrated embodiment, the holding members **90** are formed as a section of the lower member **22** in place of a section of the steel track. Due to the additional height of the holding members **90** compared to the thickness of the web **24** of the track, the column **20** at the end of the wall panel **10** where the connection **84** is used may be slightly shorter than the other columns, since the bottom of the column **20** at the end of the wall panel will be raised in comparison to the bottom of the remaining end columns of the wall panel. In FIG. **6**, the track is illustrated as stopping where the holding members **90** begin. Alternatively, the track can extend to the end of the wall panel, so long as a slot is cut into the track in order to avoid blocking the connecting bar **88** from being inserted into slot **86**. As an additional alternative, the holding members **90** could be disposed entirely beneath the track, so that the lower member **22** includes both the steel track and the two holding members **90** attached to a bottom of the track. This configuration allows the connection **84** to be provided by merely including the holding members **90** as a part of the lower member **22** below the steel track, and no other modification to the lower end of the wall panel is necessary.

All references, including publications, patent applications, and patents, cited herein are hereby incorporated by reference to the same extent as if each reference were individually and

specifically indicated to be incorporated by reference and were set forth in its entirety herein.

The use of the terms "a" and "an" and "the" and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms "comprising," "having," "including," and "containing" are to be construed as open-ended terms (i.e., meaning "including, but not limited to,") unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., "such as") provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

What is claimed is:

1. A wall panel configured as a load-bearing structure for supporting vertical loading in a building, the wall panel forming a frame with first and second faces configured to receive sheathing and having a frame thickness defined between the first and second faces, the wall panel comprising:

a plurality of axial load-bearing vertical columns for collectively supporting the vertical loading in the building, each of the plurality of vertical columns being centrally disposed between the first and second faces of the wall panel frame;

a load distribution member disposed at a top of the wall panel and coupled to the plurality of load-bearing columns, the load distribution member providing a support platform for loads disposed on top of the wall panel that are part of the vertical loading of the building, the load distribution member operating to direct the loads down and through each of the plurality of axial load-bearing vertical columns, and the load distribution member being wider than each of the plurality of axial-load-bearing vertical columns such that a gap is formed on either side of the wall panel;

a lower member disposed at a bottom of the wall panel and supporting the plurality of load bearing columns, the lower member being wider than each of the plurality of axial load-bearing vertical columns such that the gap extends across a height of the wall panel;

a plurality of first sheathing supports disposed on a first side of the plurality of the load-bearing vertical columns within the gap, each of the first sheathing supports including an attachment surface disposed at a distance from the load-bearing vertical columns, the attachment surfaces of the respective first sheathing supports, along with the load-distribution member and the lower member, defining the first face of the wall panel frame and being configured to hold a sheathing on the wall panel frame; and

a plurality of second sheathing supports disposed on a second side of the plurality of the load-bearing vertical columns within the gap, each of the second sheathing supports including an attachment surface disposed at a distance from the load-bearing vertical columns, the attachment surfaces of the respective second sheathing supports, along with the load-distribution member and the lower member, defining the second face of the wall panel frame and being configured to hold a sheathing on the wall panel frame.

2. The wall panel of claim **1**, wherein the first and second sheathing supports extend horizontally along a length of the wall panel.

3. The wall panel of claim **1**, wherein each of the plurality of first sheathing supports extends vertically and parallel to a respective neighboring column of the plurality of load-bearing vertical columns.

4. The wall panel of claim **3**, wherein each of the plurality of first sheathing supports is disposed at a distance from the respective neighboring column so as to form the gap between the plurality of first sheathing supports and plurality of load-bearing columns, the gap extending along a length of the wall panel.

5. The wall panel of claim **4**, wherein each of the plurality of first sheathing supports is coupled to the respective neighboring column by at least one solid spacer.

6. The wall panel of claim **5**, wherein each of the plurality of first sheathing supports is coupled to the respective neighboring column by a plurality of spacers disposed apart from one another along a height of the respective column.

7. The wall panel of claim **4**, further comprising at least one cross brace extending diagonally across the height and length of the wall panel, the at least one cross brace being disposed within the gap between the plurality of first sheathing supports and plurality of load bearing vertical columns.

8. The wall panel of claim **3**, wherein the wall panel is free of horizontal bridging extending between the load-bearing vertical columns.

9. The wall panel of claim **1**, wherein the load-bearing columns are steel tubes having a generally rectangular cross section.

10. The wall panel of claim **1**, wherein the load distribution member includes a structural channel with a web disposed on a top end of the load-bearing vertical columns and two flanges extending downward from the web on opposite sides of the load-bearing vertical columns.

11. The wall panel of claim **10**, wherein the load distribution member further includes a guide element attached at a lower end of each downwardly extending flange of the structural channel, the guide elements providing a guide support on opposite sides of the load bearing vertical columns.

12. The wall panel of claim **1**, wherein the load distribution member includes a horizontal flat bar with a lower side face disposed on a top end of the load-bearing vertical columns.

13. The wall panel of claim **1**, further comprising a vertical flat bar extending up from the load distribution member, the

vertical flat bar being centrally positioned with respect to the first and second faces of the wall panel frame.

14. The wall panel of claim **1**, further comprising a vertical holding bar extending up from the load distribution member and disposed at an end of the wall panel, the vertical holding bar being configured to form a connection with at least one holding member disposed at a bottom of an adjacent wall panel.

15. The wall panel of claim **14**, wherein the vertical holding bar includes holes for receiving bolts to form the connection with the at least one holding member of the adjacent wall panel.

16. The wall panel of claim **1**, wherein the lower member includes two holding members disposed at an end of the wall panel and being configured to form a connection with a holding bar disposed at a top of an adjacent wall panel.

17. The wall panel of claim **16**, wherein each of the two holding members includes holes for receiving bolts to form the connection with the holding bar of the adjacent wall panel.

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